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No. 833,593. PATENTED OCT. 16, 1906.

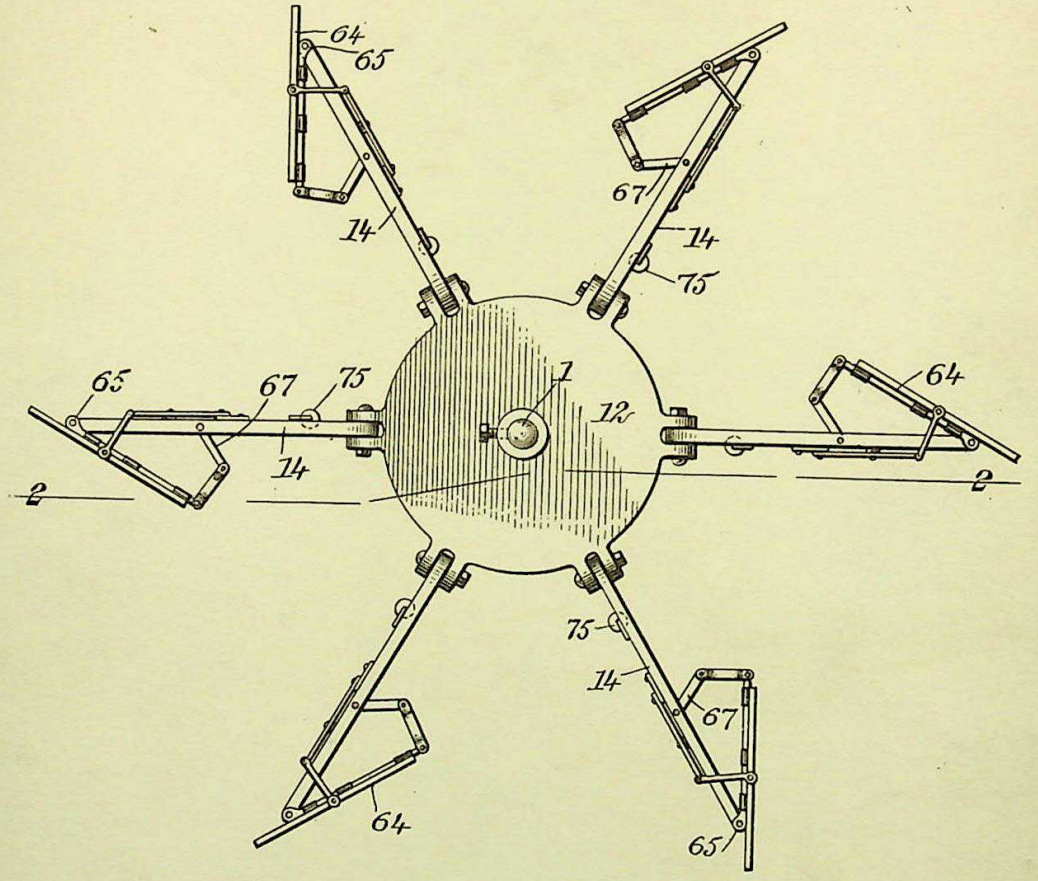
F. M. ESPINOSA.

WINDMILL.

APPLICATION FILED JULY 14, 1905.

4 SHEETS—SHEET 1.

Fig. 1.



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170.-MOTORS. FLUID CURRENT.
31

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4 SHEETS—SHEET 2.

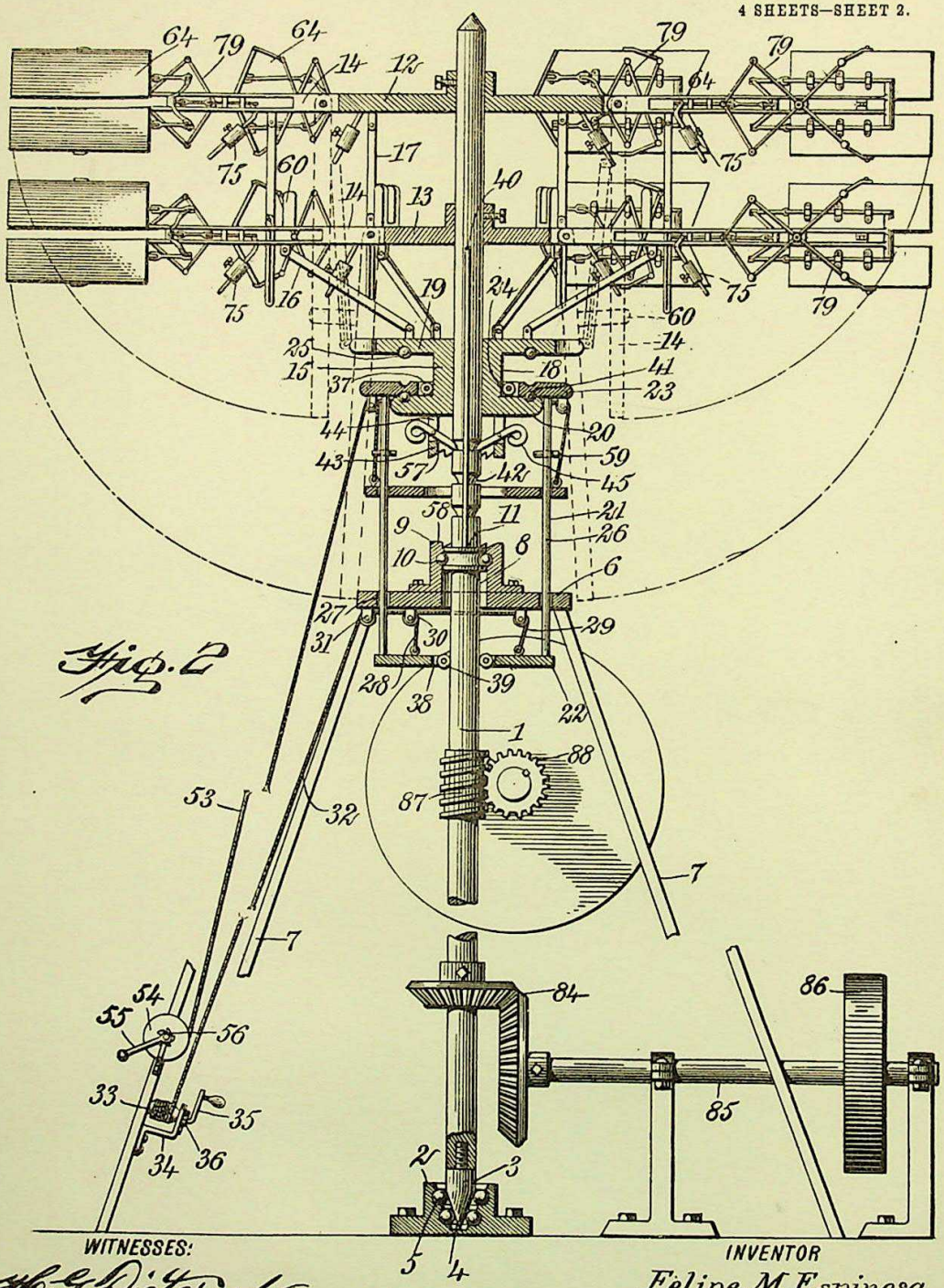

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 3.

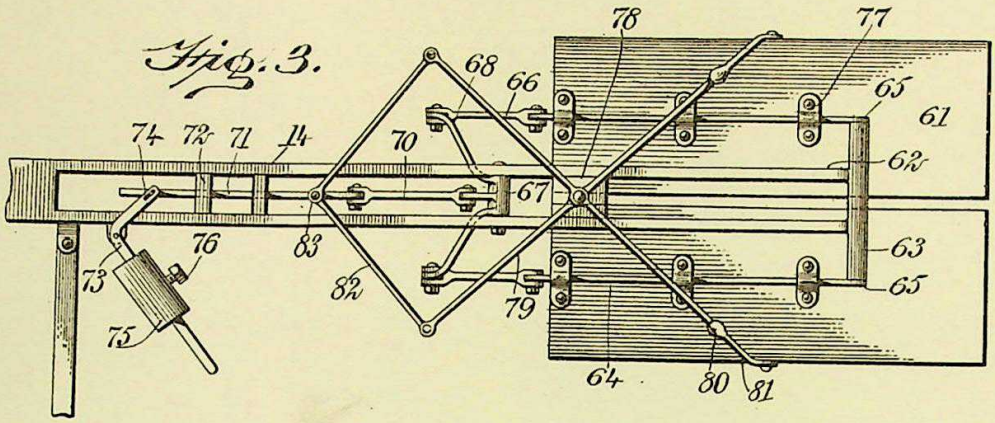


Fig. 4.

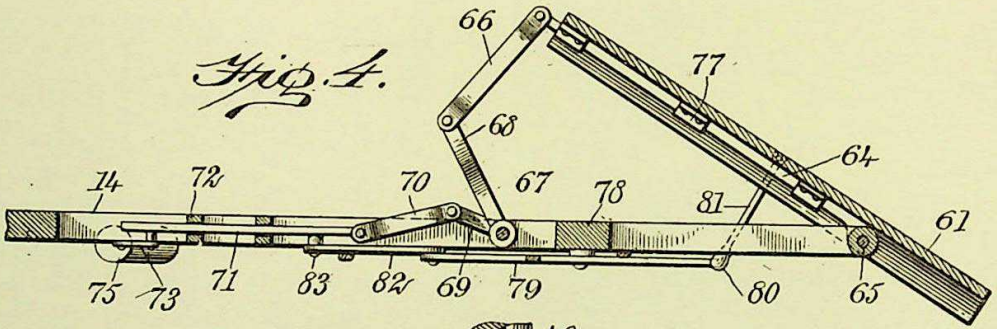
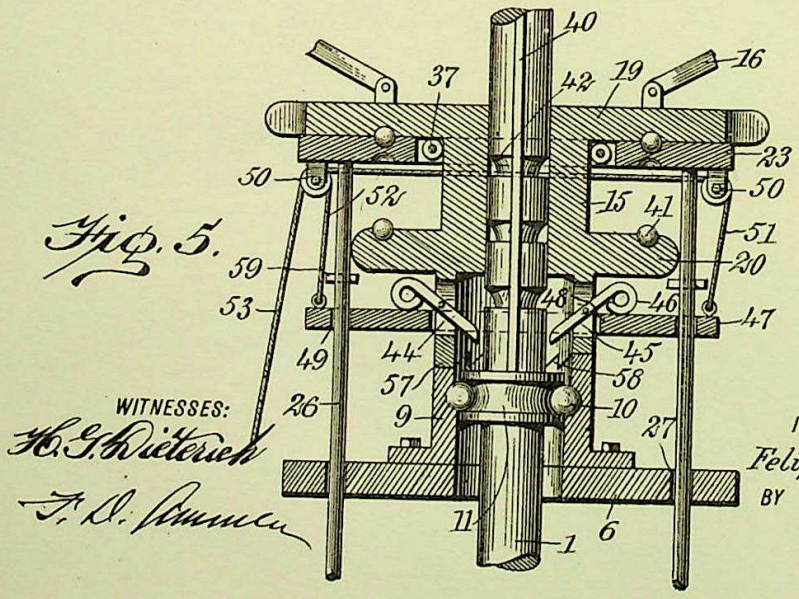


Fig. 5.



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4 SHEETS—SHEET 4.

Fig. 6.

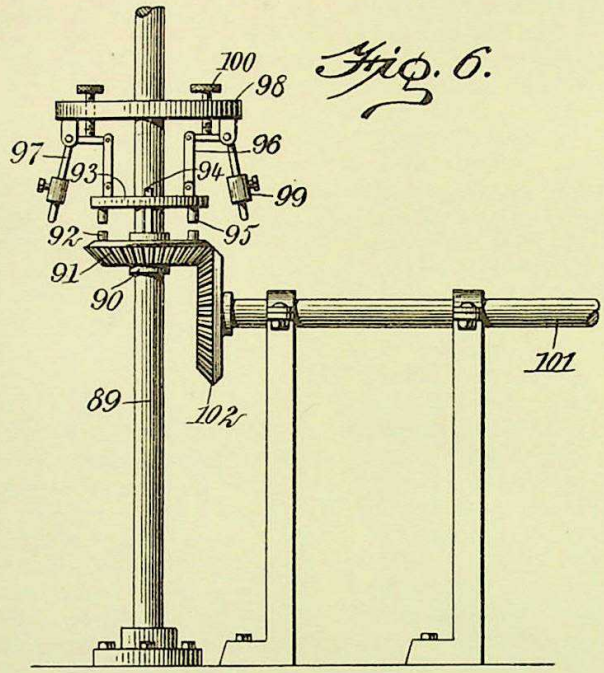
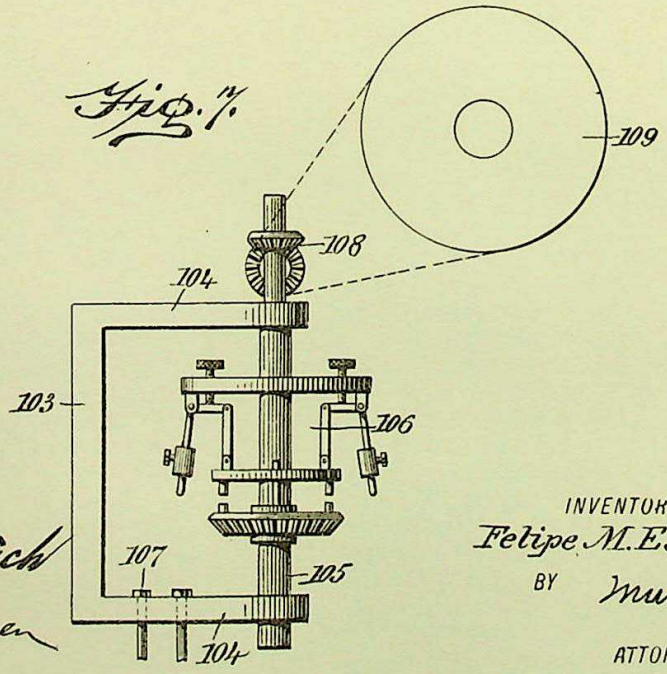


Fig. 7.



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25-6, 234 W. W. Horiz.
666, 03-2 "
665, 420 "
73-5, 497 " Feath. Bl.
690, 95-0 "

UNITED STATES PATENT OFFICE.

FELIPE M. ESPINOSA, OF NEW YORK, N. Y.

WINDMILL.

No. 833,593. Specification of Letters Patent. Patented Oct. 16, 1906.

Application filed July 14, 1905. Serial No. 269,613.

To all whom it may concern:

Be it known that I, FELIPE M. ESPINOSA, a citizen of the Republic of Mexico, and a resident of the city of New York, (Stapleton,) borough of Richmond, in the county of Richmond and State of New York, have invented a new and Improved Windmill, of which the following is a full, clear, and exact description.

This invention relates to windmills; and the object of the invention is to produce a mechanism of this kind which, having folding arms, may be extended at will and, further, to provide improved means for controlling the position of the vanes and governing the power developed by the mill.

The invention consists in the construction and combination of parts, to be more fully described hereinafter and definitely set forth in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a plan of the upper portion of a windmill constructed according to my invention. Fig. 2 is a vertical section taken substantially upon the line 2 2 of Fig. 1, the vanes, however, being at a different angle from that shown in Fig. 1. In this view certain parts are broken away. Fig. 3 is a side elevation, upon an enlarged scale and representing the outer extremity of one of the arms which carry the vanes. This view illustrates especially the governing mechanism for the vanes. Fig. 4 is a horizontal section through the mechanism shown in Fig. 3. Fig. 5 is a vertical central section taken through a runner by means of which the arms of the windmill are extended. In this view certain parts contiguous to the runner are represented as broken away. Fig. 6 is a side elevation of the lower portion of the windmill-shaft, showing a governor which I may use in connection therewith; and Fig. 7 is a side elevation showing an arrangement I may adopt enabling the governor to be inserted in a line of shafting which has been previously erected.

Referring more particularly to the parts, 1 represents the vertical shaft of the windmill, which is mounted at its lower extremity in a step-bearing 2. At this point the shaft is preferably provided with a removable special tip 3, having a conical point 4. The bearing 2 is conically bored, as indicated, and provided with balls 5, running in suitable raceways, thereby materially reducing the friction at this point. This shaft 1 is maintained in an erect position by means of a guide-plate 6, which is supported rigidly in a horizontal position upon inclined standards or legs 7. This guide-plate 6 is provided with an enlarged central bore 8, through which the said shaft 1 passes, as indicated. At this point the material of the guide-plate is extended upwardly, so as to form a hub 9. On the inner face of this hub a raceway is provided for balls 10, and a collar 11 is attached at this point to the shaft, which collar engages the balls, as indicated, so that a substantially frictionless bearing is produced at this point. The construction of this guide-plate itself will be described more fully hereinafter.

Near the upper extremity of the shaft 1 I provide heads 12 and 13, which are rigidly attached to the shaft, as will be readily understood. The head 13, which is located below the other, is preferably of somewhat smaller dimensions, as indicated. These heads are preferably of circular form. As indicated most clearly in Fig. 1, these heads have pivotally attached thereto a plurality of radially-projecting arms 14. These arms are adapted to fold down into a vertical position, as indicated by the dotted lines in Fig. 2; but they are normally maintained in a substantially horizontal position, as shown in full lines in the same figure. In order to raise and lower these arms as suggested, I provide a runner 15, which is adapted to slide up and down upon the shaft 1. The upper portion of this runner is expanded into an enlarged head, to the upper face whereof a plurality of inclined links 16 are attached. The outer extremities of these links attach to the arms 14, which are carried by the lower head 13. It should be understood that the arms which attach to the head 12 are located directly above those which attach to the head 13, and the arms are connected by links 17, so that when the lower arms are extended they will operate to extend the upper arms. In order to enable the runner 15 to be raised and lowered, it is formed, preferably, with a reduced neck 18, the said neck connecting the heads 19 and 20 of the runner. I further provide a lifting-bracket 21, which comprises a lower plate 22, disposed below the guide-plate 6, and an upper plate 23, disposed between the heads 19 and 20. This upper plate 23 is provided with a central opening 24, which receives the

neck 18 of the runner, as indicated, and said plate is adapted to slide vertically upon said neck, as will be readily understood. On the under side of the head 19 a ball-race is provided, in which balls 25 are retained, and these are adapted to engage the upper face of the upper plate 23 when the latter is forced upwardly thereagainst, as will be readily understood. The plates 22 and 23 of the lifting-bracket are connected by stems 26, and these stems pass upwardly through guide-openings 27, formed in the guide-plate 6. Arrangement is made for raising the lifting-bracket. For this purpose the lower plate 22 thereof is suspended upon cords 28 and 29, which pass over pulleys 30 and attach in suitable eyes on the upper face of the plate, as indicated. From the pulleys 30 the cords 28 and 29 pass horizontally along the under side of the guide-plate 6, to which the said pulleys are attached. Preferably near one edge of the guide-plate a guide-pulley 31 is provided, through which the cords pass, and the cords then unite to form a single cord 32, which passes downwardly to a drum 33. This drum is rotatably mounted by means of a bracket 34, which is attached to one of the aforesaid inclined legs 7, and is further provided with a crank 35 and ratchet and pawl 36. From this arrangement evidently by rotating the crank 35 the lifting-bracket 21 may be forced upwardly. In order to reduce the friction between the neck 18 and the upper plate 23, the inner edge of the opening 24 is preferably provided with friction-rollers 37, as indicated. The lower plate 22 is provided with an opening 38, through which the shaft 1 passes, and this opening is provided with friction-rollers 39, which have the same function as the rollers 37 just referred to. It should be understood that when the mill is in operation the runner rotates with the shaft 1. For this purpose the runner is preferably locked against rotation upon the shaft by means of a longitudinally-disposed key-seat 40. As the upper plate 23 of the lifting-bracket may come in contact with the lower head 20 of the runner, I provide the upper face of the head 20 with balls 41, which are retained therein and which reduce the friction of the rotation at this point, as will be readily understood.

Arrangement is provided for supporting the runner 15 at different elevations, so that the arms 14 may be maintained in a horizontal position or in intermediate inclined positions as well. For this purpose I provide the surface of the shaft at suitable points with circumferential grooves 42, and I also provide the under side of the runner 15 with an extension or sleeve 43, which projects downwardly, as shown. The wall of this sleeve is provided with slots or openings 44, in which are pivoted pawls 45. The said pawls project into the bore of the sleeve 43, inclining downwardly, as indicated, and their outer extremities are bent so as to form heads 46 for a purpose which will appear presently. These heads by the action of gravity operate to maintain the inner extremities of the pawls in contact with the surface of the shaft. From this arrangement it should be understood that if the cable 32 is wound upon the drum 33 the upper plate 23 of the lifting-bracket may engage the upper head 19 of the runner in such a way as to slide the same vertically upward upon the shaft. This relation of the parts is illustrated in Fig. 5. Furthermore, as the runner moves upwardly the pawls 45 will come into engagement with the grooves 42 and if allowed to rest in one of the said grooves will operate to support the runner, as will be readily understood. Evidently when the pawls are in engagement with the uppermost of the grooves the arms 14 will occupy a horizontal position, as indicated in Fig. 2. If, however, the pawls occupy either of the lower grooves, the arms will be held extended in an inclined position. There are preferably three of the grooves 42, as indicated, though in practice there may be as many of them as desired.

Arrangement is made for releasing the pawls 45. For this purpose I provide a releasing-plate 47, which is formed with an enlarged central opening 48, adapted to receive the sleeve 43, as indicated in Fig. 5. This releasing-plate is provided with openings 49, through which the stems 26 pass, enabling the releasing-plate to be guided upon the said stems, as will be readily undertsood. To the under side of the upper plate 23 I attach pulleys 50, and about these pulleys cords 51 and 52 pass, the lower extremities of said cords being attached to the upper face of the releasing-plate, as indicated. The cords 51 and 52 unite to form a cord 53, which passes downwardly, as indicated in Fig. 2, and is received upon a drum 54, said drum being provided with a suitable crank 55 and a ratchet and pawl 56. From this arrangement by taking up the cord 53 the releasing-plate 47 may be slid upwardly into a position such as that indicated in Fig. 5. In this way the upper face of the releasing-plate may be brought into contact with the heads 46 of the pawls 45. In this way the inner extremities of the pawls will be forced downwardly and out of engagement with the grooves 42. In this connection it should be understood that the cord 32 should be pulled slightly at this time, so as to move the runner upwardly just as the disengagement is effected. When the pawls 45 have been released, as indicated, the runner may be allowed to descend, so that the arms 14 will assume their folded position, as suggested above.

Arrangement is made for locking the runner against rotation when in its most depressed position, and in this way the shaft

and arms of the windmill are locked against rotation. For this purpose the lower extremity of the sleeve 43 is provided with teeth 57, and the upper extremity of the hub 9 is provided with corresponding teeth 58. When the runner is lowered upon the guide-plate 6, these teeth will interlock, as indicated in Fig. 5, so that the runner locks itself rigidly upon the guide-plate.

I provide means for preventing the releasing-plate 47 from engaging the pawls unless the lifting-bracket 21 is slightly raised at the same time. For this purpose I provide the stems 26 with stops 59, which are located at a suitable elevation, as indicated in Figs. 2 and 5. As shown in Fig. 2, if the releasing-plate were elevated without elevating the lifting-bracket the plate would engage the stops before it engaged the pawls. If, however, the lifting-bracket is raised at the same time with the releasing-plate, as indicated in Fig. 5, the releasing-plate may operate efficiently, as described above, and release the pawls.

I provide an arrangement for locking the upper row of arms 14 to the lower row when they are folded, as indicated in dotted outlines in Fig. 2. For this purpose the lower arms are provided with forks 60, which project vertically upward when the lower arms are in a horizontal position. When these lower arms are folded downwardly, the forks 60 then project substantially horizontally, and between the tines thereof the lower extremities of the upper arms are received, as indicated. In this way the rigidity of the superstructure of the windmill is much increased.

The construction of the vanes 61 of the windmill and the manner of attaching the same to the arms 14 will now be described.

Near their outer extremities the arms 14 are bifurcated, as indicated in Fig. 3, so as to present oppositely-disposed parallel bars 62. These bars are integral at their outer extremities with a vertical cross-head 63. To the extremities of this cross-head 63, which project above and below the arms, as indicated, are attached vane-spindles 64, the same being pivotally connected at 65, so as to swing in a horizontal plane. To the outer extremities of these spindles 64 links 66 attach. At a suitable point between the bars 62 I attach a bell-crank lever 67, provided with diverging arms 68, the extremities whereof attach, respectively, to the links 66. The short arm 69 of the bell-crank lever 67 is connected with a link 70, and the opposite extremity of this link connects pivotally with a governor-rod 71. This rod is mounted to slide longitudinally of the arm and is guided for this purpose through alining openings provided in guide-blocks 72, said guide-blocks being disposed in the space between the bars 62. Near the extremity of the governor-rod 71 which lies remote from the bell-crank lever 67 a bell-crank lever 73 is connected by a pin-and-slot connection 74, the slot being formed in the bell-crank lever, as indicated. This bell-crank lever is pivotally mounted, as indicated, and to its depending arm a counterweight 75 is adjustably attached by means of a set-screw 76. The vanes 61 are attached by hinge-clips 77 to the aforesaid vane-spindles 64. At a suitable point between the bars 62 I attach a rigid block 78, and to this block is pivotally attached a pair of tongs 79, said tongs comprising crossed arms, the extremities whereof have universal joints 80, connecting them with links 81, which links are attached to the outer edges of the vanes, as indicated in Fig. 3. To the inner extremities of the arms of the tongs 79 links 82 are attached, and these links are attached at the point 83 to the aforesaid governor-rod 71. From this construction it will be understood that the vanes are movable upon the spindles 64 by means of the tongs, and at the same time the angular position of the spindles 64 with respect to the arms 14 as viewed in Fig. 4 may be adjusted. The construction is such that the vanes will normally maintain themselves at a slight angle to each other, as indicated in Fig. 2. It will be understood, further, that when these vanes are rotated upon their spindles so as to give them the greatest projected area upon a vertical plane they will present the greatest resistance to the passing wind; but a diminished rotative effect will result, because this evidently depends upon the difference of the resistance of the two sides of the wheel. With the vanes opened out as shown the greatest rotative effect will be produced by the wind. If the angle between the vanes were diminished to zero, evidently the rotative effect would be reduced to nothing. The counterweight 75 affords means for controlling the position of these vanes automatically. In this connection it should be understood that if the windmill should tend to rotate at too great a velocity the centrifugal force acting upon the weight 75 will force the same outwardly. This will operate to draw the governor-rod 71 inwardly. This movement of the governor-rod, operating through the bell-crank lever 67, will draw the vane-spindles 64 inwardly toward the arm and will operate the tongs 79, so as to fold the vanes into a more inclined position. By this latter folding inward of the vanes on their spindles toward a zero angle, the rotative effect of the wind becomes decreased, as described above.

In order to transmit the power from the main shaft 1, I provide bevel-gears 84, through which a horizontal shaft 85 may be driven, said shaft 85 carrying rigidly a pulley 86. This pulley 86 affords means for driving any machinery desired by means of a belt. The power may also be taken from the shaft

1 by means of a worm 87, rigid therewith, which meshes with a worm-wheel 88. This of course will give a reduced rotative speed for the driven shaft, but the rotative force will be proportionately increased.

Where the windmill is to be used to drive a dynamo, I provide an arrangement whereby the driving of the dynamo will not begin until the windmill-shaft has attained the required velocity. This mechanism consists of a governor, which is illustrated very clearly in Fig. 6. In this figure the shaft 89, which is the windmill-shaft, is provided with a rigid collar 90, and upon this collar there is loosely mounted a bevel gear-wheel 91. This bevel gear-wheel is provided on its upper face with studs 92, which project upwardly, as indicated. Just above the position of the bevel gear-wheel 91 a collar 93 is mounted to slide upon the shaft, but is locked for rotation therewith by means of a key and key-seat 94. This collar 93 is provided on its under face with studs 95, which correspond in position to the studs 92 and which may engage therewith if the collar 93 is sufficiently depressed. By means of links 96 the collar 93 is suspended from bell-crank levers 97, said bell-crank levers being pivoted to the under side of a governor-wheel 98, which is rigidly attached to the shaft, as will be readily understood. The bell-crank levers 97 have depending arms with adjustable counterweights 99. In the governor-wheel 98 a pair of set-screws 100 are mounted, the extremities whereof project below the plate and are adapted to engage the inner arms of the bell-crank levers 97. The purpose of these adjusting-screws will be described more fully hereinafter. From this arrangement it should be understod that when the rotative speed of the shaft 89 increases sufficiently the arms of the bell-crank levers carrying the weights 99 will fly outwardly and the collar 93 will be depressed until the studs 95 come into engagement with the studs 92. When this occurs, the rotation of the shaft 89 will be transmitted to gear-wheel 91. The motor will be driven from a horizontal shaft 101, carrying a rigid bevel gear-wheel 102, which meshes with the gear-wheel 91. If it is desired to drive the shaft 101 continuously without respect to the speed of rotation of the shaft 89, the set-screws 100 will be screwed up, so as to adjust the collar 93 downwardly. In this way engagement would be brought about between the studs 95 and 92. There would be no change in the condition of the governor with changes in speed of the shaft 89.

In practice it may be desired to attach the governor just described in a piece of line-shafting which has been already erected. To effect such an arrangement as this, I provide a bracket 103, having horizontal arms 104, as shown in Fig. 7. In the extremities of the said arms 104 I mount a short section of shaft 105, and between the arms a governor 106 is provided, similar to the governor shown in Fig. 6, which has just been described. The shaft 105 extends, as indicated, above and below the arms 104, and when it is desired to set the governor in position a sufficient length of the line-shaft would be removed or uncoupled and the shaft 105 substituted therefor. The bracket 103 may be secured in position by bolts 107 passing through the lower arm thereof, as indicated. At a suitable point on the shaft 105 bevel-gears 108 are arranged, which afford means for driving a wheel 109, so that, if desired, power may be taken from the shaft above the governor instead of below the same.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a windmill, in combination, a plurality of arms, vane-spindles pivotally attached to said arms, vanes rotatably mounted on said spindles, governor-weights, mechanisms connecting said governor-weights with said spindles for controlling the angular position of said spindles upon said arms, and mechanisms connecting said governor-weights with said vanes for controlling the position of said vanes upon said spindles.

2. In a windmill, in combination, an arm, a vane-spindle pivotally attached to said arm, a vane rotatably attached to said spindle, a governor-rod, means for mounting the same to slide longitudinally on said arm, a governor-weight controlling said rod, mechanism connecting said rod with said spindle for controlling the position of said spindle, and mechanism connecting said governor-rod with said vane for controlling the position of said vane upon said spindle.

3. In a windmill, in combination, a plurality of arms disposed in sets one above the other, links connecting the corresponding arms of said sets, a central shaft supporting said arms, a runner slidably mounted on said central shaft, links connecting said runner with said arms, and means for actuating said runner to raise or lower said arms.

4. In a windmill, in combination, a central shaft, a plurality of arms supported thereby and adapted to fold in vertical planes, a runner slidably mounted on said shaft, connections between said runner and said arms for raising or lowering said arms, said shaft having circumferential grooves in the surface thereof, pawls carried by said runner and adapted to engage said grooves, and a movable releasing-plate adapted to release said pawls to disengage the same.

5. In a windmill, in combination, a central shaft, a plurality of arms supported thereby and adapted to fold in vertical planes, a runner slidably mounted on said shaft, connections between said ruuner and said arms for raising or lowering said arms, said shaft hav-

ing circumferential grooves in the surface thereof, pawls carried by said runner and adapted to engage said grooves, a movable releasing-plate adapted to release said pawls to disengage the same, and a guide-plate through which said shaft passes and upon which said runner may seat, said runner and said guide-plate having interlocking teeth.

6. In a windmill, in combination, a guide-plate, a central shaft rotatably mounted therein, a plurality of folding arms supported on said shaft above said guide-plate, a runner slidably mounted on said shaft above said guide-plate, mechanism connecting said runner with said arms for raising or lowering the same, a lifting-bracket guided on said guide-plate and engaging said runner to actuate the same, and means for actuating said lifting-bracket.

7. In a windmill, in combination, a guide-plate, a central shaft rotatably mounted therein, a plurality of folding arms supported on said shaft above said guide-plate, a runner slidably mounted on said shaft above said guide-plate, mechanism connecting said runner with said arms for raising or lowering the same, a lifting-bracket guided on said guide-plate and engaging said runner to actuate the same, means for actuating said lifting-bracket, and means for locking said runner in an elevated position.

8. In a windmill, in combination, a guide-plate, a central shaft rotatably mounted therein, a plurality of folding arms supported on said shaft above said guide-plate, a runner slidably mounted on said shaft above said guide-plate, mechanism connecting said runner with said arms for raising or lowering the same, a lifting-bracket guided on said guide-plate and engaging said runner to actuate the same, means for actuating said lifting-bracket, means for locking said runner in an elevated position, and a releasing-plate guided on said lifting-bracket and affording means for releasing said runner.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FELIPE M. ESPINOSA.

Witnesses:

F. D. AMMEN,

JNO. M. RITTER.